



General operating instructions

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Fire emergency number: 112

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Preliminary remarks

When using chemicals, special rules of conduct and safely precautions must be adhered to. Legal requirements when using hazardous substances are in effect.

Hazardous chemicals are substances, mixtures and articles used in the workplace that can be a health or physicochemical hazard if not handled or stored correctly. There are nine hazard pictograms in the GHS which represent the physical, health and environmental hazards:

Exploding bomb Flame	Flame	Flame over circle
		
Explosive	Flammable	Oxidising
Gas cylinder	Skull & crossbones	Exclamation mark
		
Gases under pressure	Acute toxicity	Health hazards
Corrosion	Health hazard	Environment
		
Corrosive	Chronic health hazards	Environmental



Substances that produce hazardous substances or alloys when handled or used, as well as substances that carry pathogens, are considered hazardous substances also.

Substances for which characteristics are not yet fully known also have to be treated as hazardous substances.

The intake of substances into the human body (incorporation) can happen through inhaling (through the lungs), through skin contact (also through intact skin) or through swallowing (mouth and gastro-intestinal).

1. General rules

In principle, any person beginning work at the Institute for Inorganic Chemistry is obliged to register at the Institute's office beforehand.

Researchers will receive an occupational safety folder in which the occupational safety guidelines applicable at the Institute are documented. The safety folder also contains an instruction form for carrying out the initial safety briefing at the place of work. The briefing must be carried out in the laboratory before the lab work begins. The documentation of this briefing must be handed over to the office immediately after the instruction has been carried out. The briefing is carried out by the respective supervisor or a qualified person appointed by the supervisor.

The above obligations for registration and instruction also apply to research interns. A supervisor assigned by the respective research group leader is responsible for ensuring these obligations are met.

1.01 The following steps are mandatory to read before starting to work in the laboratory and their content is to be observed:

- General operating instructions, laboratory regulations,
- Substance group and single substance operating instructions for substances that are handled,
- Further occupational operating instructions for the workspace,
- Guidelines for laboratories and accident prevention regulations,
- Working safely in laboratories,
- For female employees: instruction sheet about maternity protection. Pregnant women are obliged to immediately inform the employer about a pregnancy, for reasons of their own safety.

1.02 Before handling hazardous substances or conducting experiments that might release hazardous substances, the potential risks have to be determined (hazard analysis). All necessary safeguard measures have to be kept in place in order to prevent harming other people.

Sources of information:

- List of chemicals from the chemical-store, catalogs from manufacturers,
- Safety data sheets from manufacturers,



- Operating instructions, standard operating procedures, scientific literature,
- External databases.

Hazard notes have to be documented in the laboratory journal before starting the experiment. A hard copy of the laboratory journal must be kept due to safety regulations. In case of emergencies it will help inform paramedics and firefighters.

- 1.03 Unknown substances have to be considered hazardous and handled at least according to the Precautionary statements P270, P260, P262, P305, P351, P338 (**Precautionary statements**). Do not inhale the substance and avoid contact with eyes or skin.
- 1.04 For female employees special prohibitions for employment when handling hazardous substances are in place. Expectant and breast-feeding mothers are, for their own safety, obliged to notify the employer in a timely manner about these circumstances.
- 1.05 It is mandatory to ensure that toxic, very toxic, carcinogenic, mutagenic and teratogenic substances are prevented from contaminating the air, the “normal” laboratory environment and the “normal” general waste.
According to the skin protection protocol one is required to practice precautionary skin protection.
- 1.06 Hazardous substances are not allowed to be removed from the university grounds without official authorization.

2. Storage of hazardous substances

- 2.01 An inventory list about commonly used chemicals in laboratory work, research groups and other fields of work is required at all times official hazardous substance register. There the Software DaMaRIS must be used. The chemical inventory must be inspected at least once a year. Chemicals that are not needed anymore have to be disposed of safely and in a timely manner. It is also necessary to inspect the correct and permanent labeling of all containers.
In the chemical locker it must be noted where the inventory list is kept. This list should be accessible to the safety inspector at all times.
- 2.02 Chemicals stored in the workplace are only allowed in small amounts that are necessary for conducting the experiment. This is especially important for flammable substances. The permitted allowance is normally the amount needed for one day. Bottles for ordinary use may not larger than 1 liter.
- 2.03 Hazardous substances are not allowed to be stored or kept in containers that can be confused with edibles.
- 2.04 Self-flammable, oxidizing, and flammable substances have to be stored separated from each other. When using glass jars for the storage of self-inflammable substances the jars have to be placed in break-safe jars.



When handling self-inflammable substances precautionary extinguishing measures have to be determined with the supervisor.

Flammable substances are not allowed to be stored in a locker that does not have a ventilation system.

2.05 Flammable substances are only allowed in cooling devices in which the interior is free of ignition sources, and need to be labeled on the outside with "Für Chemikalien umgerüstet, nur Innenraum frei von Zündquellen" (Refitted for chemicals, only interior free of ignition sources).

2.06 All containers need to be labeled permanently, legibly and unambiguously, with the following:

- Name of owner
- Chemical name or chemical formula of the substance (no abbreviations)
- Relevant hazard symbols and warnings (P- and H- statements)

The content of cooling devices has to be inspected at least every six months. The leak proof nature and suitability of the containers, their permanent and legible labelling and the necessity of further storage need to be assessed.

Substances that are not needed anymore are to be disposed of in a timely manner. The date of the last and next inspection needs to be specified legibly on the outside.

2.07 Toxic substances have to be locked away.

Substances labelled with "Danger" or "Warning" have to be stored in a manner such that external people have no direct access to them.

2.08 All standard containers have to be at least labeled with the name of the substance, the relevant hazard symbols. Containers with a capacity of over 1 liter have to be labelled completely, including all warnings (P- and H- statements in full length).

2.09 Chemicals must be inspected for mix-ups upon delivery.

3. General protection and safety regulations

3.01 You have to inform yourself about possible alarm signals (e.g. fire alarm inside the building or inside the overnight rooms) as well as about the location and mode of operation of emergency stop valves/cut-off switches for gas, water and electricity.

Notices for maintenance work on technical facilities have to be respected. Anyone who uses an affected room is responsible for all equipment and chemicals which might be harmful within this timeframe. Chemical experiments should be stopped until the end of maintenance work, due of safety reasons. You have to assume that the maintenance worker is not able to assess all chemical dangers.



- 3.02 Outside the established working hours (timeframe: Monday to Friday from 6:00 am to 8:00pm), workers are only allowed to handle hazardous substances or work on chemical equipment when approved by the supervisor. This needs to be verifiable.

It is necessary in every case, that at least two competent assistants with a completed chemical training (or degree) are present and within earshot. This is necessary when handling hazardous substances or when working on chemical equipment, in order to be able to help each other or call for help.

Trainees are under no circumstances allowed to be in the laboratory without supervision. Undergraduates need a subject-matter and hazard specific orientation from their advisor.

Fire-proof rooms with an automated fire-extinguishing system are only allowed to be entered with at least two people, so one person can ensure a safe emergency exit.

- 3.03 Unauthorized people are forbidden entering to laboratories.

Workers from outside the university (e.g. mechanics) are only allowed in the laboratories after prior agreement, in order to not endanger experiments, employees and non-professionals.

Rooms that are accessible by cleaning staff have to be secured by the workers in the laboratory so the cleaning staff cannot unintentionally injure or endanger themselves.

- 3.04 Escape and evacuation routes are not allowed to be blocked by objects. Self-locking doors that separate the buildings into different fire areas are not allowed to be blocked.

- 3.05 Floor and basin drains have to be filled with water or closed with a rubber plug in order to close off the sewage pipe against the existing vacuum.

- 3.06 The front slide of fume cupboards have to be closed, and their working order must be inspected regularly. Faulty fume cupboards must not be used, and have to be reported to maintenance.

- 3.07 Fire extinguisher and fire extinguishing sand boxes have to be refilled after every use. Fire extinguishers that have a damaged seal have to be handed in for inspection by maintenance (room K33a, Zentralbau Chemie).

- 3.08 Safety goggles with side protection and preferably a wide coverage of the eyes have to be worn at all times in the laboratory. Wearer of prescription glasses have to either wear safety goggles with prescription lenses or wear safety goggles above their own glasses.

- 3.09 Appropriate clothing has to be worn as well as a lab coat with long sleeves, made of non-flammable and non-melting fabrics.

- 3.10 Only sturdy, closed-toed and slip-proof shoes are allowed in the laboratory.



- 3.11 Eating and drinking in the lab is prohibited. In the evaluation rooms, it is permissible to drink from closed containers, provided that it is ensured that no hazardous substance is carried over from the laboratory to the evaluation room.
- 3.12 Body protection is stated in the precautions-statements (P-statements) and safety precautions (e.g. protective gloves) have to be used.
- 3.13 Working with toxic or aggressive hazardous substances is only allowed in a fume cupboard.
- 3.14 Unsupervised experiments during the day and experiments through the night are only allowed in the fire-proof night rooms.
- 3.15 When handling extremely toxic substances the staff of neighboring laboratories has to be informed in a timely manner and provisions in case of emergency have to be put into effect.
- 3.16 The laboratory and the working space is supposed to be kept clean and orderly. At the end of the workday the working space should be secured.
- 3.17 Facilities that serve for security purposes are not allowed to be made ineffective or tampered with. (e.g. safety lids of centrifuges).
- 3.18 Cooling in the laboratory

When one is finished using flammable solvents for cryogenic baths, the solvent should be poured back into a storage vessel and stored in a secure place (Fire hazard!).

Dewar flasks have to be completely dry and clean before they can be filled with liquid gases!

Dewar flasks are not allowed to be used without an intact shell.

Cryogenic gases (e.g. liquid nitrogen) are considered hazardous substances and have to be handled with the necessary precautions. When transporting liquid nitrogen or helium in an elevator no people are allowed to ride in the elevator.

Be careful when cooling with liquid nitrogen so that no other gases will condense unnoticed inside the equipment (e.g. oxygen, argon).

- 3.19 Pressurized gases

Compressed gas cylinders have to be returned to the storage room after finishing with the experiment, in order to allow for regular safety checks. If this does not happen the person who is borrows the cylinder is demmed negligent.

The responsibility for the disposal of pressurized gases that were not acquired through the institute (especially donations) lies with the supervisor of the working group.



Compressed gas cylinders have to be secured from falling over and are only allowed to be transported with a screwed on safety cap.

Compressed gas cylinders with valve that cannot be opened by hand have to be decommissioned and brought to the gas cylinder storage.

Compressed gas cylinders that contain harmful gases are only allowed to be stored under vacuum.

Pressurized gases are not allowed to be stored with flammable solvents.

Borrowed compressed gas cylinders are not allowed to be fully emptied. The remaining overpressure has to be upheld until delivery to the filling station, by closing the valve.

Needle valves for corrosive gases have to be washed with distilled water and dried after removing them from the compressed gas cylinder.

Pressure reducers for corrosive gases should never be cleaned with fluids. They should be blown out with inert gas and closed with a rubber plug so that no moisture can enter.

3.20 Autoclaves

Autoclave equipment has to be inspected by a qualified person on a regular basis, according to regulations. This is also the case for display equipment, security valves and warning devices. It is prohibited to work on uninspected equipment that has no valid documentation. The facilities have to be secured against unauthorized use.

3.21 Evacuating:

All glass vessels have to be visually inspected before using them for evacuation. When there is a risk of explosion or implosion, the apparatus need to be equipped with shatter protection (e.g. a see-through window screen or a strip curtain). Only flasks that are approved for evacuating are allowed to be used. Measurements for preventing boiling retardation must be taken.

3.22 Working with UV and laser light

When working with UV and laser light appropriate protection goggles have to be provided at the working station and worn at all times (this is also necessary for visitors). The protection class has to be indicated so that it is clearly visible on the equipment.

3.23 Working with substances that require a license

The intention of working with such substances has to be reported to the director of the institute in a timely manner, so certain exemption limits are not exceeded. Furthermore, all legal regulations have to be complied with. Requests for permits have to be authorized by the director of the institute.

3.24 Working with sharp and pointed objects

When drilling holes into a rubber plug it has to be placed on a stable pad so it cannot slip away.



When inserting glass parts into rubber plugs hands have to be protected with cloth rags or towels. It is prohibited to work with broken glass parts.

Injection needles have to be disposed of in special containers, so there is no potential risk of injuring the cleaning crew.

3.25 Noise:

In the workspace noise should be kept to a minimum as best as possible in accordance with the work noise.

3.26 Security measurements when using heat guns

Do not use heat guns in close proximity to flammable liquids. Do not put the heat gun down in close proximity to spilled solvents as they can catch on fire, this is also necessary in a fume cupboard.

Heat guns have to be treated like open ignition sources (e.g. ignition point of diethyl ether air mixtures: 170 °C).

4. Waste

4.01 As far as it is possible laboratory waste has to be immobilized and neutralized inside the laboratory, in order to keep risks for transporting and storing as low as possible.

4.02 When finishing the practical training or finishing with the research study (e.g. PhD thesis) all remaining substances have to be completely removed and disposed of safely.

4.03 Substances that can still be used should be registered electronically (DaMaRIS), as far as it is possible, and when requested given to other working groups.

4.04 Waste containers have to be labeled meticulously. Labels are not allowed to be written over. Old labels that are not accurate anymore have to be removed.

4.05 Containers for transporting have to be sealed airtight.

5. Behavior in case of emergency

1st principle: personal safety overrides material protection

5.01 Alarm signal of the Argon – fire extinguishing system in some fume cupboards (honk):

The extinguishing system consists of a compressed gas cylinder filled with argon as extinguishing gas, which is additionally provided with a fragrance (lemon). A compressed gas bottle supplies 5 to 6 fume hoods in two different rooms. After activating the manual release or after triggering the heat detector when reaching 68 °C, the horn and strobe light are activated and the control unit's signal light turns red. The smoke detectors in the rooms do not trigger an extinguishing process! The sash of the affected fume hood closes automatically. Sideshift must be closed manually! The ventilation is switched off in the affected fume hood and the alarm is signaled to the technical company (Tel. 84444). The fire department is not informed automatically! Electricity and cooling water are not switched off. 10 seconds after triggering, the release



of the extinguishing Argon takes place. People are instructed to leave the room, as larger amounts of argon flow into the night room. The responsible persons are to be informed immediately.

The room must be properly ventilated before re-entering is allowed. The fire extinguishing system can only supply one single extinguishing process for one single fume hood. Overnight experiments in all fume hoods connected to the automatic fire extinguishing system released must be stopped until the system is operational again.

Leave the rooms promptly, close the door. If the fire continues, call the fire department (112 or firebox). Notify the responsible person. Maintenance-Service-Center will be automatically notified with only an incident report, this is why they should be notified by phone also (84444). The rooms is only allowed to be entered after being aired out thoroughly.

5.02 Alarm signal for lack of oxygen

When the alarm is sounding inside the NMR or X-ray rooms (honk, light) the rooms should be evacuated instantly and the person responsible for the room should be notified. Maintenance-service-center will be automatically notified with an incident report, this is why they should be notified by phone also (5203). There is no automatic onward transfer of the alarm to the fire department.

One should not enter the room where an alarm is sounding without taking special precautions. Because large amounts of liquid nitrogen and helium are released there is th epotential risk of suffocation.

5.03 Behavior in case of a fire alarm (inside the building) (siren)

Cut off the gas, turn off heating devices, keep the cooling water running, close all windows, and leave the building via the safest evacuation route. Make sure all rooms on all floors are evacuated (check bathrooms also!), gather outside the building and wait for the all-clear signal.

Notify the responsible people.

The fire alarm of the building is automatically forwarded to the fire department and the police.

5.04 In case of fire, gas, fume and chemical leakage, or accidents:

Keep calm, and avoid acting rashly or thoughtlessly. Quickly inform or ask for help from other people (superiors, colleagues, assistants, and other people from the institute) about the danger. Make sure you are safe first and if necessary evacuate parts of the building which might be in danger!

Evacuate injured people from the danger zone and administer first aid. Do not leave injured people by themselves.



Shut down endangered experiments and if necessary cut off gas and electricity. Cooling water has to stay running. Try to contain the danger.

Try to reduce the danger when it is possible without harming yourself. If this is not possible call for help: rescue service (emergency number 112) or the fire department (fire alarm) or maintenance.

When making an emergency call give following information:

- Location of the building, the part of the building and the number of the laboratory
- What kind of danger (fire) or what kind of accident happened
- Number of injured people and what kind of injuries they have
- Wait until the rescue service has ended the call, do not hang up before that!

Assistants should meet the rescue services outside of the building and direct them towards the emergency.

Poison control center:	München	phone 089/ 19240
	Berlin	phone 030/ 19240
	Bonn	phone 0228/ 19240
	Freiburg	phone 0761/ 19240

5.05 Fire

In case of fire the fire department has to be called immediately (112). Until they arrive the fire should be kept down by all means possible as long as it is safe. All people that are not needed for putting out the fire should evacuate the danger zone immediately.

People in charge should be contacted (supervisor of research group, director of the institute).

If there was any contact with hazardous substances or if people are feeling unwell or show signs of skin reactions one should immediately go see a doctor. An accident report has to be filed with the safety representative or with the administration of the institute.

6. Principles for first aid

6.01 When helping others always make sure to be safe yourself! If necessary call for help (112).

6.02 Put out burning clothing with the emergency showers.

6.03 Evacuate all people from the danger zone and take them outside where they can get fresh air.

6.04 Monitor breathing and circulation. If the injured person is conscious, passive leg-raising might be necessary (lift legs up a little bit and take pressure off joints).



- 6.05 When unconscious but still breathing the person should be brought into a lateral recumbent position, or otherwise the head should be hyperextended until the person is breathing again. If the person does not start breathing one should start ventilation immediately (CPR).
- 6.06 Clothes that are stained with spilled chemicals have to be removed quickly unless they stick to the skin (then one should cut around these parts). If necessary undress until naked and wash off all chemicals with lots of water (emergency shower), when there is no skin damage soap may be used as well. Substances that are water-resistant can be washed off with PEG (polyethylene glycol) and rinsed off with water later.
- 6.07 When eyes are damaged by acids or alkalis they should be washed out with a soft water stream while making sure to not harm the uninjured eye. Eyelids should be held open and rinsed for at least 10 minutes. (Do not use "aqua dest.!"!)
- 6.08 If there is blood, use disposable gloves, stop the bleeding, and loosely wrap the wound in a sterile bandage.
- 6.09 Injured people should not be left alone until there is medical help present. If necessary one should organize transportation to the doctor. Have information about the accident ready for the doctor.

The directors of the institute.

Würzburg, 30.06.2021

Prof. Dr. T. Marder

Prof. Dr. H. Braunschweig

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